

Claims:

1 1. (original) A method for installing a heat exchange pipe loop in a borehole, the
2 method comprising

3 drilling a borehole from an earth surface down into earth using
4 sonic apparatus with a sonic drill head, the sonic drill head having casing
5 connected thereto, drill apparatus connected to a lower end of the casing so
6 that movement of the casing by the sonic drill head drills the borehole down
7 into the earth, the casing having an interior,

8 pumping drilling fluid down into the casing during drilling, down
9 through the casing and out through the drilling apparatus, and upwardly in an
10 annular space between an interior surface of the borehole and an exterior
11 surface of the casing so that drilled material flows upward through the annular
12 space in the borehole preventing drilled material from flowing up into the
13 casing's interior,

14 lowering a heat exchange pipe loop down into the casing,

15 introducing grout into the casing around the heat exchange pipe
16 loop, the grout displacing an amount of the mixture of drilling fluid from within
17 the casing, and

18 extracting the casing from the borehole.

1 2. (original) The method of claim 1 further comprising

2 introducing grout into the casing as the casing is extracted from
3 the borehole.

1 3. (original) The method of claim 1 further comprising

2 introducing grout into the borehole around the heat exchange pipe
3 loop after the casing has been extracted from the borehole.

1 4. (original) The method of claim 1 further comprising

2 oscillating the casing with the sonic apparatus as the casing is
3 extracted from the borehole.

1 5. (original) The method of claim 4 wherein the oscillating of the casing
2 accomplishes at least one function from the group consisting of: facilitation of casing
3 extraction; inhibiting grout bridging; de-aerating the grout; increasing density of the

4 grout; oscillation of drilled material; and reduction of friction between the casing and
5 the grout.

1 6. (original) The method of claim 1 further comprising
2 oscillating the casing as grout is introduced into the casing.

1 7. (original) The method of claim 1 further comprising
2 adding drilling fluid additive to the drilling fluid during drilling.

1 8. (original) The method of claim 1 wherein the borehole is at least 300 feet
2 deep; the borehole is drilled, the heat exchange pipe loop is lowered, the grout is
3 introduced, and the casing is extracted within one hour.

1 9. (original) The method of claim 1 further comprising
2 introducing water into the heat exchange pipe loop to inhibit
3 collapse of the heat exchange pipe loop.

1 10. (original) The method of claim 9 wherein the heat exchange pipe loop is
2 substantially filled with water and is sealed following filling with water.

1 11. (original) The method of claim 9 wherein the water is pumped at a pressure
2 of about 100 p.s.i.

1 12. (original) The method of claim 1 wherein the grout is introduced into the
2 casing by pumping the grout into the casing.

1 13. (original) The method of claim 1 wherein the grout is introduced into the
2 casing by pouring the grout into the casing.

1 14. (original) The method of claim 1 wherein the grout includes set retardant
2 material.

1 15. (original) The method of claim 1 wherein the heat exchange pipe loop is
2 made from material from the group consisting of polyethylene, steel, aluminum,
3 aluminum alloy, zinc, zinc alloy, composite and fiberglass.

1 16. (original) The method of claim 1 wherein the sonic apparatus is on and is
2 movable by a truck or crawler apparatus, the method further comprising
3 moving the sonic apparatus adjacent a location of the borehole.

1 17. (original) The method of claim 1 further comprising
2 pumping a volume of drilling fluid into the casing that is greater
3 than a volume of drilled material.

1 18. (original) The method of claim 1 wherein the casing comprises a string of
2 interconnected pieces of casing and pieces of casing as needed are added to the string
3 as drilling progresses.

1 19. (original) The method of claim 1 wherein the drill apparatus is a bit or
2 drillshoe with an outer diameter within 110% of an outer diameter of the casing.

1 20. (original) The method of claim 1 wherein the drilling produces drilled
2 material and substantially all of the drilled material does not exit from the borehole at
3 the earth surface.

1 21. (original) The method of claim 1 further comprising
2 removing the drill apparatus from the lower end of the casing,
3 inserting a secondary drilling apparatus through the casing, and
4 drilling an extension of the borehole with the secondary drilling
5 apparatus.

1 22. (original) The method of claim 21 wherein the secondary drilling apparatus
2 is from the group consisting of: a coil tubing drilling system; a compressed air drilling
3 system; and a downhole motor drilling system.

23. (cancelled)

24. (cancelled)